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MONTHLY REVIEW

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EDITORIAL

Now that we are acquainted and you, dear members, know that we of the Editorial staff only desire to inform without moralizing, and to pass on to you the progress of your fellow members' experiments and the results of his practice, without offending.

The Editor is asserting one of his prerogatives in use of the word WE, as it is commonly known that the only people privileged to use this word are Editors and people with tapeworms.

Have you ever seen a paper on the practice used by yourself in your daily efforts as an Electro-Plating Executive, if not why not. This is your paper and don't you think a little initial effort is greater than to applaud or criticize the other fellow; and each year this Society gives prizes for best and most valuable articles printed and read at Society meetings, and the judges may pick your paper if you will write one.

Maybe you have forgotten just what our monthly review is for. To establish direct control between our branches and membership, to promote and facilitate progress of our industry, to furnish authoritative information on our experiments, to encourage and foster that spirit of clean debate and criticism that will make us loyal seekers of new things and better citizens.

FOURTEENTH ANNUAL CONVENTION OF THE AMERICAN ELECTROPLATERS AT NEWARK, NEW JERSEY, JUNE 28, 1926

Subject: "Apprenticeship Training in the Public Schools," by Robert O. Beebe, Director of the Essex County Vocational Schools.

Mr. President and Gentlemen: To successfully carry on the work of yours as well as other crafts or fields of endeavor, there are two elements that much be reckoned with—namely the human and the material. Both of these elements require study and careful handling if we are to reach the maximum degree of efficiency comparable to our efforts.

I notice that most of your program is devoted to the reading of technical papers, intended, I assume from the subjects, to lay before you a great wealth of information regarding the latest experimentations, investigations and discovered facts regarding the material part of your work.

Yet none of these things would be possible were it not for the alert and competent human element involved and I am sometimes minded that in our enthusiasm and anxiety to improve the output and increase production, stimulated by the urge of competition we give our thoughts to the discovery and perfection of new material facts and things, expecting that somehow the human element will adjust itself to the new order.

I am neither a chemist nor an electroplater and cannot therefore talk to you in the technical language of your profession, but because of my keen interest in the practical education of all who must seek their livelihood in the work-a-day world I esteem it a privilege, Mr. Chairman, to address this convention on the general subject of "Specialized Training for the Job and How the Public Schools Can Assist."

If I am correctly informed, the electroplating trade or profession has undergone tremendous changes and new and improved methods must be employed by the plant that aspires to keep the pace in production and competition. I am told that the time was when the mixing of a plating solution was somewhat a matter of chance which depended largely upon the judgment and experience of some trusted employee. If the solution turned out poorly and could not be corrected it was

thrown away and a new solution prepared. This meant loss of time and spoilage of work.

Today such methods would be ruinous to any plant. As a result of careful scientific research and experiment it is fast becoming possible to prepare the proper solutions, to use the correct and most efficient mechanical appliances and to employ the most effective processes to meet most any demand of the trade, and this without taking the chance of imperfect work or spoiled goods.

But this changing from the haphazard to the highly scientific methods calls for better prepared and qualified men to handle the work. If men are to proceed in this work on a technical basis they must be trained to do the work intelligently and understandingly. By this I do not mean that the employee must have a college degree or that he must necessarily spend years of training in higher institutions of learning. His preparation needs to be specialized and intensive rather than general and prolonged. His first duty in the plant will be to follow directions and he must be prepared to interpret these directions whether they be in mathematical formulas or chemical symbols.

In this special training the public schools can and should be an important factor. It remains for you to realize the possibilities for service in the public schools and to place your special problems before the educational authorities of your respective communities. I am convinced that they will co-operate with you in the same cordial manner that the Board of Education of the Vocational Schools in this county has co-operated for the past two years with the Newark Branch of your organization.

There is no reason why the laboratories of the public schools should not be opened to you for research and experimentation and for the improvement of those already engaged in the electroplating industry and by the same token there is no reason why courses in industrial chemistry cannot be carried on in the evening schools in other places as they are in this county in close co-operation with the local branches of the American Electroplaters Society, whose direct purpose shall be to train and pre-adjust the right human material to the requirements of the electroplating industry.

We are living in an age of specialization and men as well

as boys who would contribute the highest order of service must have special training for their particular jobs. Our professional men as well as our tradesmen specialize. We have corporation lawyers, criminal lawyers, land and title lawyers, patent lawyers and many others. Our confidence is no longer placed in the family physician, for we may find a specialist for most any part of our anatomy that happens to be out of repair. If you will pick up your evening paper and look for an advertisement calling for an all-around printer, I think you will be unsuccessful, for I have not seen such an advertisement for some time and yet a few years ago such notices were quite common. You will observe many advertisements for compositors, linotypers, make-ready men, pressmen, rulers, paper cutters, etc. The electrical trade breaks up into specialties too numerous to mention, ranging from house-wirers and cable-splicers to high-tension installation men and power house maintenance men. The carpentry trade breaks up into house framers, floor layers, inside finishing men and many others.

The same condition prevails today in practically every other trade and the all-around professional man and tradesman exist only in the very small community. This condition has been brought about in most instances by the need for increased production, but in some other instances by the restrictions enforced by organized labor. But whatever the cause the situation must be met and the answer is a challenge to the public schools for more special and less general education.

The future success of your work, I believe, will depend in no small measure upon the extent to which you realize and take advantage of these opportunities for the training of your men who are engaged in this important industry and of the boys who must some day succeed them in the work.

In closing, let me say that we in Essex County are very proud of the record made by the members of your local chapter who have attended the course of instruction in the laboratory of our Boys' Vocational School in Newark during the past two seasons and I would like to refer you to them for further information as to the possibilities for improvement of the work in courses of this character.

ZINC PLATING FROM ACID BATHS[1]

By M. R. Thompson

I. Introduction

Zinc plating or electrogalvanizing is so extensively used for protecting iron and steel against corrosion that little comment on its importance is needed. It was proposed in France as early as 1840, introduced in this country about 1890 and by 1905 was being used quite widely. Up to 1916, most commercial plating was confined to acid baths, but at that time the alkaline cyanide bath also began to be used. In spite of the importance of acid zinc baths and the long experience with them, few extensive researches on the subject have been published, and it is safe to assume that practice has changed little during the last twenty years. It was hoped to conduct an extensive survey during the course of this investigation[3] of acid zinc baths at this Bureau, but it was soon apparent that unusual difficulties prevented radical improvement of present methods. Only the most promising points, therefore, could be selected for preliminary study in the available time.

It is well known that acid zinc baths are characterized by poor throwing power and a tendency to produce coarsely crystalline deposits. To overcome the latter defect, numerous addition agents, usually organic, have been proposed for making the deposits smoother and brighter. There has been much less uniformity in composition of bath than in nickel or copper plating, perhaps because numerous formulas for zinc baths gave about the same result. It has been customary to use a high concentration of a zinc salt, sulfate or chloride, or both, together with a low concentration of a sodium, ammonium or magnesium salt to improve conductivity. As will be brought out subsequently, relatively high concentrations of the latter salts are required to produce a marked effect on conductivity.

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[1]Published by permission of the Director of the Bureau of Standards, Department of Commerce.

[2]Chemist, Bureau of Standards.

[3]Further details of this work are given in a paper to be presented at the Washington Meeting of the American Electrochemical Society, October 7-9, 1926 and to be published in Volume 50 of their Transactions.

II. Experimental

Acidity. As the acidity or pH has been found very important in nickel plating, its effect on zinc plating was studied first. It was found that a pH range from 3.5 to 4.5 is suitable for securing high cathode current efficiency and good deposits which, just as with nickel, are somewhat finer, grained when the pH is low. In this range, moreover, there is no excessive anode corrosion such as is caused by the chemical attack of more acid zinc solutions. The indicator, bromphenol blue, was found reliable for the control of pH.

Aluminum salts, such as alum or aluminum sulfate, have been much used in zinc baths. When these sales are present and the pH is raised, aluminum hydroxide begins to precipitate at a pH slightly above 4 and when 4.5 is reached only a small concentration of aluminum is left in solution. The precipitated aluminum hydroxide is readily redissolved by adding acid. In baths without aluminum salts, such as those containing acetates or boric acid, a higher pH may be used. The limiting pH is that at which zinc hydroxide itself precipitates, which has been shown by previous investigators to occur at about 6. This value, therefore, constitutes the upper limit for all simple acid zinc baths.

In order to maintain a definite pH, it is desirable to add a "buffer," which prevents any great change when a small amount of acid or alkali is added. Aluminum salts act as buffers through the formation of colloidal or precipitated aluminum hydroxide, or basic aluminum salts, and their resolution. Acetates, citrates and tartrates all give a strong buffer effect, but only the acetate solutions are stable. Neither ammonium salts nor boric acid have an appreciable buffer action in ordinary zinc baths.

III. Polarization and Throwing Power

Previous investigators have shown that throwing power depends essentially on three factors, cathode polarization, cathode current efficiency and conductivity, of which the first is usually the most important. As preliminary experiments showed that zinc solutions as a rule possess comparatively slight polarization, special efforts were made to improve this condition.

For a given current density and acidity, the usual methods of increasing polarization depend on: adding a common ion;

increasing the solution viscosity; using an addition agent, usually an organic substance; or forming complex ions. The common ion effect, as produced by adding sodium sulfate to a zinc sulfate bath, or sodium or ammonium chloride to a zinc chloride bath, was found to be very small. These additions also increase the viscosity, which may be further raised by adding such substances as "corn sirup," or glycerin. When tried, however, it was found that both the latter failed to increase materially the useful polarization.

A few organic substances were also tried as addition agents, including dextrin, dextrose ("corn" or "grape" sugar), "corn sirup" (dextrin plus dextrose) and beta-naphthol. These experiments are not here reported in detail, as with the exception of dextrin, which slightly increased the polarization and produced much smoother and finer-grained (although darker) deposits, no very encouraging results were obtained. At low current densities, these additions seemed to have little effect on the natural tendency of zinc to deposit in isolated, coarsely-crystalline growths (furnishing slight protection to the base metal), while at high current densities they often tended to produce defects, such as pits, blisters or streaks and dark or spongy deposits. As it was possible to study the action of only a few of these substances in the available time and as this is a large field for investigation, no generalizations will be attempted. It is quite possible that other addition agents, used singly or in combination, might give better results than were here obtained.

Sodium citrate was tried for the complex ion effect, but no marked increase in useful polarization was found when it was used in the presence of inorganic salts, such as sulfates or chlorides. In alkaline zinc cyanide baths, which were outside the scope of the present research, zinc is, of course, present in complex ions. A few tests on a typical commercial cyanide bath, which were made merely for comparison, showed that the high throwing power of such baths is due chiefly to their high polarization.

Tests on a wide variety of acid zinc baths showed that the cathode current efficiency is very high (nearly 100 per cent) when the pH is 4 or above and the current density is above 5 amp./sq. ft. (0.5 amp./dm^2), although it decreases greatly at lower current densities.

The resistivity of acid zinc baths of the usual commercial type was found to be from about 15 to 25 ohm-cm at 25° C. (77° F.). A typical zinc cyanide bath has a resistivity of 7 ohm-cm.; nickel plating baths range from 9 (high sulfate) to 25 ohm-cm.; acid copper baths for electroplating or electrotyping range from 3 to 5 ohm-cm.

The throwing power of all the acid zinc baths tried was close to zero and was not greatly increased by any improvement in polarization, current efficiency or conductivity that could be effected.

IV. Baths of High Conductivity (Low Resistivity)

In view of these facts, the most promising way of improving the conditions in zinc deposition, other than throwing power, appeared to be by using more highly conducting baths. In such baths very high current densities can be applied which permit more rapid plating and produce better deposits. In electro-deposition, raising the average current density, up to a certain point, causes brighter and finer-grained deposits, while increasing the conductivity permits raising the average current density without causing roughness or treeing on sharp edges. Accordingly, the baths listed in Table 1 were devised and tried in extensive laboratory tests with results that justify their commercial trial.

TABLE 1

PROPOSED ACID ZINC PLATING BATHS

		Concentration			Throwing Power[1] Total Current on 2 dm^2		Resistivity at 25° C. (77° F.)
	Composition	N	g/L	oz/gal	Amp.	T %	ohm-cm.
(1)	Zinc sulfate ..... ($ZnSO_4.7H_2O$)	2	288	38	0.50	—2	8
					2.00	+1	
	Sodium chloride. (NaCl)	3	175	23			
	Aluminum sulfate ($Al_2(SO_4)_3.18H_2O$)	0.25	28	4			
(2)	Zinc chloride .... ($ZnCl_2$)	2	136	18	0.50	+3	5
					2.00	+2	
	Sodium chloride. (NaCl)	4	234	31			
	Aluminum chloride ($AlCl_36H_2O$)	0.25	20	3			

(3) Zinc chloride.....	2	136	18	0.50	+1	3
($ZnCl_2$)				2.00	+2	
Ammonium chloride	4	214	29			
NH_4Cl)						
Aluminum chloride	0.25	20	3			
($AlCl_36H_2O$)						

Operating Conditions. The favorable conditions of operation for these baths were found to include a pH of 3.5 to 4.5, ordinary temperature, and a cathode current density of 15 to 45 amp./sq. ft. (1.6 to 4.8 amp./dm²) on articles of fairly simple shape in still solutions. With sufficient motion of cathode or in agitated solutions, up to 150 amp./sq. ft. (16 amp./dm²) may be used in some cases. The anode current density may be the same, or higher. To deposit a zinc coating with an average thickness of 0.0006″ (0.015 mm.), such as is frequently used on articles subjected to moderate exposure, requires about 500 ampere-minutes per sq. ft. Therefore, at 100 amp./sq. ft. (10.8 amp./dm²) this average thickness is produced in about 5 minutes. Dextrin in these baths, e. g. 4 oz./gal. (30 g/L) produces smoother deposits, but these are darker and the permissible current density is lowered.

These baths should be especially useful in barrel plating on account of their high conductivity. The deposits from them were found to be unusually smooth and bright. Although aluminum has been at various times supposed to deposit as an alloy with zinc, none could be detected in these deposits. There are serious difficulties involved in depositing aluminum from aqueous solution and such deposition has never been satisfactorily confirmed. Besides aiding in regulating the pH and thereby preventing the pH of the cathode film from reaching too high a value, it is probable that colloidal aluminum hydroxide is of benefit in producing smoother and brigher deposits. The effect of aluminum salts upon both the solution and the deposit has been often mentioned by other authors.

Warming these baths would still further lower the resistivity (raise the conductivity), but is undersirable as it causes coarser-grained deposits.

The composition of the suggested bath is simple. Methods

[1]For total current on 2 dm² (31 sq. in.) in a throwing power box with 5/1 ratio and capacity of 6 L (1.6 gal.).

of chemical control merely involve measurement of pH and the titration of zinc and chloride. The content of the latter could probably be controlled approximately by specific gravity readings. Determinations of aluminum will only be required occasionally, likewise sulfate in bath No. 1. The exact concentrations given in Table 1 are not essential and considerable variation is permissible.

In general, bath No. 2 gave somewhat brighter deposits and changed less rapidly in pH than the others. It is, therefore, especially suggested for trial. As these baths have very low throwing power it is obvious that they are unsuited for plating objects of very irregular shape, at least unless it is feasible to resort to specially shaped anodes.

Possible Difficulties. One objection to "high chloride" baths, especially when agitated, is the increased tendency toward corrosion of copper bus bars. These may be protected to some extent by occasional greasing, or it may even be found preferable to substitute bus bars of aluminum. The latter are also attacked by chlorides, but no new nor harmful constituent is thereby introduced into the solution.

Another possible objection is the deteriorating effect of zinc chloride on wood tanks, which can, however, be sufficiently protected by bituminous linings. Still another objection that may arise is the increased solubility, in chloride solutions, of lead from low grade anodes, which might conceivably cause trouble. There is slight justification, however, for using other than the pure zinc anodes which are now so readily obtainable.

These baths are not very close to the saturation point of the salts at ordinary temperature, but an extreme temperature drop, especially if long continued, may cause precipitation. Any such precipitate should be readily redissolved on warming. It is desirable to prevent chilling of the baths in cold weather as the conductivity is materially sacrificed and likewise the permissible current density. Under some conditions dilution of the baths may be necessary. While the exact concentrations are not essential, as previously mentioned, dilution has the same effect on the operation as lowering the temperature.

Protective Value. The question may possibly arise with zinc coatings, as it has occasionally with nickel, of the protective

value on steel when deposited from chloride baths. Recent tests have shown no inferiority of nickel deposits due to chloride in the solutions. It is difficult to settle this point for zinc without having available the results of long experience. Zinc chloride baths have been proposed and no doubt considerably used. A few preliminary salt spray and atmospheric exposure tests of zinc coatings of moderate thickness from these chloride baths have shown an entirely normal behavior.

V. Conclusions

1. Good results in zinc plating from acid baths are obtained in the range of pH 3.5 to 4.5, which can be controlled by the indicator, bromphenol blue.

2. Aluminum salts act as buffers and also cause whiter and brighter deposits, but without actual deposition of aluminum.

3. It was not found possible in these experiments to materially increase the throwing power of acid zinc baths, chiefly because of low cathode polarization.

4. No important results were obtained with the few organic addition agents tried, with the exception of dextrin, which produced finer-grained (although darker) deposits.

5. It was found that acid zinc baths could be distinctly improved by using very highly conducting solutions containing largely or entirely chlorides. In such solutions very high current densities can be used and very rapid plating conducted without producing treeing or roughness.

6. Excellent results were obtained with a bath containing 18 oz./gal. (136 g/L) zinc chloride, 31 oz./gal. (234 g/L) sodium chloride and 3 oz./gal. (20 g/L) aluminum chloride (crystallized) or 1.5 oz./gal. (11 g/L) aluminum chloride (anhydrous).

7. Preliminary observations indicate that zinc coatings of moderate thickness from such baths will furnish satisfactory protection against corrosion.

Acknowledgments are due to the associates of the author at the Bureau of Standards for assistance in this work, and especially to Wm. Blum, who directed it and made many helpful suggestions.

USE OF PERMANGANATE IN NICKEL SOLUTIONS

R. L. Shepard

The use of an oxidizing agent in nickel solutions seems to have first been given considerable publicity and aroused particular interest among our membership by Chas. P. Madsen in his paper on "Mechanically Perfect Electrolytic Nickel," given before the American Electrochemical Society meeting of April, 1924. Inasmuch as Madsen covers the situation very well in his paper, a brief review thereof will serve as an excellent introduction to our discussion of the use of permanganate under similar conditions, for which he suggests the use of hydrogen peroxide.

Madsen mentions, among other common defects of deposited nickel, the lack of ductility and the presence of pits.

Lack of ductility, he states, is caused principally by soluble organic compounds in the bath, also by hydrogen and iron under certain conditions. The presence of organic material may be due to impurities in the salts used, also from contamination from dust or adhering material on improperly cleaned work. Under a wide limit of variation of other factors electrolytic nickel with a ductility equal at least to that of copper may be produced from a solution *free from organic matter.* Practically all organic matter may be removed or destroyed by chlorination and small amounts by hydrogen peroxide.

Continuing the discussion with reference to pitting, Madsen gave as its cause the catalytic action of small particles of foreign particles causing the formation of atomic hydrogen around which the metal deposits, leaving a concave well or pit. At least two of the principal classes of such particles are living organisms and ferric compounds, both soluble and insoluble, particularly a hydrated ferric oxide and a ferric oxychloride.

Madsen further states "the introduction of small amounts of hydrogen peroxide into the bath has been found to be an absolute remedy for pits and most ills of electrolytic nickel." The exact or approximate concentration of peroxide used is not stated, but is presumably small. Another valuable result of the addition is that the size of the ferric hydrate colloids seems to enlarge and can be filtered off.

He states that other oxidizing agents were tried, but none

found as beneficial as peroxide and nearly all directly or indirectly caused other troubles.

As to the effect of iron in the solution, Madsen states that in the ferrous state it tends to produce smooth deposits and diminish pitting. However, such deposits, on account of a greater iron and hydrogen content, are harder and less ductile. When present in the ferric state it tends to increase pitting. The difficulty of keeping it in the ferrous state makes it more practical to eliminate it from the bath.

APH between 3 and 6.8 is permissible, but PH 6.2 to 6.6 is preferred, facilitating the removal of ferric salts under the conditions.

In the December, 1925, issue of the Monthly Review Charles H. Proctor suggests the use of sodium perborate instead of hydrogen peroxide on account of its economy as a source of oxygen and the greater facility of handling. Its action and results in a nickel solution no doubt are identical with hydrogen peroxide when used in equivalent quantities.

About three years ago the writer encountered a very severe case of pitting in a solution which had just been transferred from one plant to another in a number of used casks, which were later thought to have been improperly cleansed of such organic matter as glucose, molasses or vinegar. The ordinary procedure of the analyst wishing to get rid of such organic matter is to oxidize with permanganate in a solution slightly acid with sulphuric acid. Acting on this thought, therefore, we treated a test portion of the solution in question with a solution of potassium permanganate dissolved in hot water. On adding this solution to the nickel bath slowly and with vigorous stitting there occurred the phenomenon typical of a permanganate titration in a weak acid solution. With the first additions the permanganate decolorized instantly. With succeeding additions a precipitate of manganese dioxide occurred, which redissolved when dispersed through the bath until a concentration was reached at which the precipitate became permanent. After this point was reached the addition was stopped.

The above solution was then tested with a rack of work which showed entire absence of pits. Another result immediately noted was the surprising ductility of the deposited nickel. A further test in which the deposit was continued for

two hours showed no trace of peeling, exfoliation or brittleness.

This experience seems to coincide with Madsen's results in the use of an oxidizing agent and to confirm his statements that organic matter is the most important cause of pitted and hard nickel deposits.

Since the incident noted above the writer has adopted the use of permanganate for the routine control of pitting and ductility of deposits. Its advantages are particularly to be noted in the breaking in of new solutions made up of the commercial nickel salts which are always more or less badly contaminated with organic matter. Every instance of this kind when treated as stated has gone into immediate production work with a satisfactory deposit free from pits.

We have also recently demonstrated its efficiency in counteracting the hardening effect of cadimum used as a brightener of our sodium sulphate nickel solutions which have been of such value in the nickel plating of die castings. In this connection we are able to get a soft bright nickel deposit with exceptionally good distribution in recessed work.

The routine care of the solutions. We treat them two or three times per week with permanganate at the rate of 1 to 5 grams per 100 gallons. The purple crystals are dissolved in hot water, preferably in a porcelain lined vessel, and then poured into the plating bath in a slow stream with vigorous stirring until a slight brown precipitate is formed which does not redissolve. Further additions are unnecessary, although we have been unable to detect any harmful result from the addition of a large excess of permanganate.

I am not prepared to state as positively as do Madsen and Proctor that the use of this addition agent will stop pitting under all conditions. I do believe, however, that it will stop pitting due to organic matter or iron. Pitting due to improper conditions of temperatures, current density, acidity, metal and salt concentration must be corrected according to their cause.

The particular advantage of the use of permanganate over peroxide or perborate is the fact that the proper amount to be added can be determined exactly by the appearance of the brown precipitate of manganese dioxide, comparable to the end point of a permanganate titration.

Detroit Branch, A. E. S., June 14, 1926.

THE ART OF DEPOSITING, POLISHING AND ETCHING ON ROTOGRAVURE CYLINDERS

By A. Knechtel and E. Scher, New York Branch

Before going into details of the process a brief history on rotogravure printing will not be out of the way.

Rotogravure has quickly gained a unique position in the journalism of America. It is an accepted and popular part of the finest newspapers and magazines and has played an important part in their growth and expansion.

The rotogravure process had its beginning in the days of Rembrandt, who was one of the first experimentors in intaglio printing, which at that time occupied much the same position as hand etching does today. It was practised by only a few enthusiasts and their product was distinctly an individual artistic achievement. It was not a process for general profitable commercial use. With the development of the camera, gravure or intaglio printing plates were made by photographic process. Its chief use was to produce famous master pieces of art. This method was improved by adopting the rotary press, from which the name rotogravure was derived.

The first successful newspaper rotogravure section was introduced in America about 1912. In 1924 to 1925 the first color rotogravure was printed, which gave another new effective sales vehicle to the advertiser. It is safe to say that this pictorial process was an advancing step on the part of the newspaper in bringing before the public the highest element of printing.

The development of the rotogravure color has only begun. There are, however, some fundamental differences in the process which have a bearing on the proper preparation of material for the printing roller.

(1) The Making of the Cylinder or Printing Roller

The cylinder or printing roller is constructed of a cast iron body with a steel shaft. The cylinder is machined and turned smooth. After the machining is done the ends of the cylinder are painted with the following composition:

Two-thirds beeswax,

One-third stearin pitch.

Then it is thoroughly cleaned in the usual manner for the cyanide copper baths. These cylinders rest on two bearings, one on each side of the tank. A pulley is attached to one side, then slowly revolved in the solution.

After cyanide plating, which takes from two to three hours, these cylinders are rinsed in water, then placed in an acid copper bath and built up with copper to the proper size, which is usually from 1/8 to 3/8 of an inch copper shell. The time required for depositing these copper shells varies from 250 to 400 hours and depends largely upon the size of the cylinders, also the density of the current, which is 30 to 50 amperes per square foot.

The next step is grinding and polishing of the cylinder. The grinding is done in a machine especially built for this purpose.

The cylinders turn in a tank of water and a grindstone is turning in the opposite direction of the cylinders. This stone travels from one end to the other of the cylinder and grinds it smooth and round.

When the grinding is finished the polishing process is started. First using a block of charcoal to polish out all scratches left from the stones, then using a polishing block with French rouge paper. This finish is the end of the polishing process.

(2) Carbon Printing

After the polishing is done, the carbon tissue which is used as a resist in the process of etching. Any variety of carbon tissue may be used as a resist, which is first sensitized in a 5% potassium bichromate solution. When sensitized the tissues are squeezed on ferrotype plates and dried in a current of air. The exposing or printing of tissues is almost exclusively done in a vacuum printing frame.

(3) Mounting or Developing

The polished cylinder is cleansed from grease and oxidation, with acetic acid and common salt. The mounting of the tissue upon the cylinder may be performed with an ordinary roller squeegee. After mounting it, it is allowed to remain on the cylinder for at least fifteen minutes before it is developed. The operation is performed by revolving the cylinder in a tank of hot water. When developing is complete the cylinder should be dried and stopped out. Then it is ready for etching.

(4) Etching

The etching is done with a solution of ferric chloride at a density of 42°, 38° and 34° of Baumé hydrometer.

The operation in etching is commenced with the strongest

and finished with the weakest. When finished the resist is removed and the cylinder is ready for printing.

NEWARK BRANCH

Newark Branch held its regular meeting on September 17, 1926, with Pres. Geo. Onksen presiding. Twenty-seven members and four visitors being present. Two applications for active membership were received and referred to the trustees..

Chas. B. Lee was elected to active membership.

A committee was appointed by the president to secure a new meeting room. Messrs. Smith, Sizelove, and Gumm were appointed.

Our Supreme Secy.-Treas. George Gehling was present and when called upon for a few words gave an outline of what Phila Branch is contemplating doing this fall in their chemistry class at Kensington High School.

Twenty-one members signified their intentions of joining the chemistry class in October at the Vocational School and were requested to give their names to Mr. Samuel Taylor who would in turn notify them when classes would begin.

Mr. Smith's motion to devote our first meeting of the month to educational papers and discussion, and the second meeting to business matters, was carried. Discussion on nickel plating of nickel-silver articles was indulged in. Meeting adjourned at 10:40 p. m.

On Friday evening, August 20, Newark Branch held its regular meeting with President Geo. Onksen in the chair. Eighteen members and one visitor, Mr. Kramarcik of Milwaukee Branch, who is employed in the vicinity of Newark. A motion was passed that we dispense with the September 3 meeting on account of it being near a holiday. All members are requested to attend the Septembr 17 meeting to decide on forming the class in chemistry at the Vocational School which begins in October.

Mr. Calabrese, the librarian, read a paper on bright nickel plating and controlling same by analysis. Discussion on bright nickel and zinc solutions was indulged in until adjournment was called for at 10:00 p. m.

CHICAGO BRANCH

Regular monthly meeting of Chicago Branch was held at the Atlantic Hotel, September 11, 1926.

The meeting was called to order with President Jacob Hay presiding and all officers present.

There was a very good attendance.

Chicago Branch is endeavoring to start a Chemistry Class this fall with our able member, Mr. Erwin Sohn, as instructor; from all indications this will be a very large class as some twenty-two members have signed up.

This class will be of two hour durations and will run for about thirteen weeks.

Members who wish to join the same are requested to send in their names as soon as possible.

Seven applicants were elected and one application was read; the balance of the evening was given over to our librarian, Mr. O. Servis, who found the following questions in the box.

CHICAGO QUESTION BOX

Qustion No. 1. What causes a nickel deposit of six to eight ten-thousands thick plated direct on steel to peel?

Answer: Solution may be too alkaline which will cause peeling; work not properly cleaned.

Question No. 2: What causes hot Cyanide of Copper solution to pit?

Answer: Lack of Cyanide was given as the cause of pitting; another stated that the solution may be too dense in metal; suggested diluting the same and adding Cyanide.

Question No. 3: What causes a wax-like scum to form on the top of Duplex Copper Solution?

Answer: If agitated, it may be caused by air compressor pumping oil, dirt or dust into room.

Question No. 4: How can you prevent corrosion of tin when cleaned in an alkaline solution?

Answer: It was suggested to use a mild cleaner such as Trisodium Phosphate with an addition of Cream of Tartar: Bichromate of Soda was also recommended.

Question No. 5: Why is oxalic acid added to a Copper Sulphate Solution?

Answer: To give a brighter and smoother deposit; Aluminum Sulphate or Boric Acid were stated to give equal good results and cost far less than oxallic acid.

Question No. 6: What is used to burnish flat steel plates 6 in. by 4 in. in a tumbling barrel; the parts are held tight and are not allowed to rub against one another?

Answer: It was recommended that barrel not run over twenty-five revolutions per minute, using a lubricant made up as follows: 30 lbs. Soap Chips, 88% Soap, balance moisture, 12 lbs. Soda Ash, 52 Gallons Water.

THE TRUE GENTLEMAN

"A MAN that's clean inside and outside; who neither looks up to the rich nor down on the poor; who can lose without squealing; who can win without bragging; considerate to women, children, and old people; who is too brave to lie, too generous to cheat, and too sensible to loaf; who takes his share of the world's goods and lets other people have theirs—this is the ideal conception of a true gentleman."

A Joint Meeting

On Saturday, September 4, fifty-eight members of the Dayton, Cleveland and Toledo Branches of the A. E. S., and six ladies journied to Mansfield, Ohio, to visit the plant of the Westinghouse Electric Products Company as the guests of Mr. Clarence Van Derau and the officials of that company.

Mr. Van Derau, who has charge of all the finishing departments of the plant acted as host and cicerone to the guests with the assistance of the company officials. The visitors were escorted through the plant in groups of ten and the various methods and processes used in the manufacture of the various products of this company were shown and explained. Wherever possible the work is routed through from start to finish on conveyors and the progressive method of building all their products is the rule. This applies as well to the assembling of the component parts as well as the finished product. It was an inspiration and a revelation to the visitors of what can be accomplished in high speed production by the use of modern methods and up to the minute equipment combined with a system of work routing that brings the sub-assembled parts to the point required at the exact time needed. The opinion of the visitors is that it is entirely unnecessary to go to Henry Ford's plant to observe progressive manufacturing methods at their best.

After the trip through the plant the entire party came together in the plant cafeteria where a splendid luncheon was served. After the inner man was satisfied and the cigars lighted Mr. Van Derau, as master of ceremonies, in a short talk explained the object of the meeting as a pioneering attempt to bring the Ohio Branches into closer fellowship together and to possibly inaugurate a plan whereby the Ohio members might make an annual meeting of this kind both pleasant and profitable. Mr. Van Derau then introduced Mr. E. M. Olin, Works Manager of the Westinghouse Electric Products Company. In his talk Mr. Olin expressed the pleasure it gave the officials of the company to throw open the plant for our inspection and to have us as their guests. He outlined conditions under which they operated, the relation of the various elements of plant, equipment, materials and men to assure successful and profitable results. Mr. Van Derau then introduced Mr. J. E. Smith, Works Superintendent; Mr. Smith discussed manufacturing conditions and problems as applied to certain of their product and the successful operation of the plant and what could be accomplished through organized effort and proper equipment. Mr. D. L. Jones, Chief Inspector, talked on methods of inspection and their value as applied to production and the relation of the inspection to the manufacturing division. Mr. E. L. Spray, Works Engineer, told how the Engineering Division co-operates to devise the necessary machinery to meet the requirements of a rapidly expanding plant. Mr. R. M. James, Works Accountant, told of the methods used in providing cost accounting to show the cost of equipment, material and labor and its relation to the profitable and successful management of the plant. The writer also spoke briefly.

It being then well into the afternoon a vote of thanks to the company officials for their most courteous reception and treatment of the visitors was proposed and adopted after which the party went by autos to inspect the Ohio State Men's Reformatory, one of the model State Institutions of Correction.

Much credit is due Mr. Van Derau for his conception and management of the affair and the opinion of all is that he has set a fine precedent for other sections to follow.

NEW YORK BRANCH

The regular meetings of New York Branch were held at the World Building, Park Row, New York, on August 13 and 27. At the first meeting plans were completed for the annual shore dinner which will be held at Tappens Hotel, Sheepshead Bay, on Saturday, September 11, a good time is in store for all who attend.

Ways and means were discussed of getting more of our members to attend our meetings, so it was decided to make our meetings more interesting by devoting the first meeting of the month to business and second to good and welfare, so as to have a whole evening a month to reading and discussion of papers.

Our President, Mr. Franklyn MacStocker, urges more of the old-timers to attend the meetings as the meetings at the present time are being attended by many new members.

INDIANAPOLIS BRANCH

The Branch held its regular meeting September 11, 1926, with a nice attendance. One new member was admitted. Mr. C. A. Ormsby spoke on the subject of cleaning, pickling and neutralizing with the electric current on work to be vitreous enameled. As this was a little out of the ordinary it was very interesting. The Branch seems to be getting some of its old-time pep in it at last.

DETROIT BRANCH

The September meeting was presided over by Vice-Pres. William Paterson. There was a fair crowd in attendance. Mr. J. E. Fritts was elected an associate member.

The second meeting of the month held on the third Friday will be discontinued on account of the poor attendance and lack of interest by our members.

Owing to a misunderstanding with the firm in which they are employed, in regards to the activities and purpose of the American Electro-Platers Society. The following members and officers have tendered their resignations, to take effect at once. William Patterson, Vice Pres.; M. Whyhe Berger, Member of Board of Managers, and M. George Kutzen, Secy.

An Emergency Election was called and following members elected to fill unexpired terms of above resignations:

Mr. Benj. Gilchrist elected Vice President.

Mr. Chas. Mascola elected Secretary.

Mr. H. A. Jameson elected Board of Managers.

This was strictly a business meeting and no plating subjects were taken up.

BOSTON BRANCH

Boston Branch met Friday the 3rd at the office of the Boston Platers Supply Co., Boston, with Vice Pres. Wright in the chair.

It was our first meeting since last June. Had eight at the meeting. Fair for the Branch.

After the regular order of business we had a discussion of the spotting out of brass plated work by Mr. Evans of the Waltham Watch Co. of Waltham, Mass. It was very interesting and a vote of thanks was extended to Mr. Evans.

Our Pres., Mr. Gale, not being present, no report was made on the last convention and will be made at the next meeting.

The meeting adjourned at 10:30 p. m.

PROVIDENCE-ATTLEBORO BRANCH

At the annual meeting of the Providence-Attleboro Branch it was voted: To establish the office of coresponding secretary, and the undersigned was elected to serve for the ensuing year.

The Branch is negotiating to affiliate with the Engineers Society—so I will notify you as soon as it is settled.

ELECTIONS

J. E. Fritts (Associate).....Detroit Branch
John A. Hanly (Associate).....Detroit Branch
Frank Wrzalla (Active).....Chicago Branch
Ralph Arnold (Active).....Chicago Branch
Jas. W. Murphy (Active).....Chicago Branch
Matt. Butzen, Jr. (Active).....Chicago Branch
Henry A. Wilkins (Active).....Chicago Branch
Joseph Cosgrove (Associate).....Chicago Branch
William Hink (Associate).....Chicago Branch
M. Chas. B. Lee (Active)....East Chattawgee, Tenn., Newark Branch

APPLICATIONS

CHICAGO BRANCH

Harvey Gausing (Active).....8256 Throop St., Chicago, Ill.

TORONTO BRANCH

Alfred G. Smith (Active).....16 Regnia Ave., Hamilton, Ont., Can.
Allan R. Groves (Active).....Box 415, Carlton Place, Ont., Can.

NEWARK BRANCH

Robert Rutherford (Active).....135 17th Ave., Newark, N. J.
Louis Steeber (Active).....381 So. 6th St., Newark, N. J.

SUSPENSIONS

George Heeney.....Boston Branch

RESIGNED

M. Frithrop Stenhagen.....Detroit Branch

BOSTON

Regular meetings are held first Friday of each month, at 8 p. m., at the Boston Platers' Supply Co., 202 Friend St., Boston. Secretary, A. W. Garrett, 24 Juliette St., Dorchester, Mass.

BRIDGEPORT

Meets first and third Friday of each month at 62 Cannon St., Room 17, Bridgeport, Conn. Secretary R. J. O'Connor, 1228 Noble Ave., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, Robt. Meyers, 2432 Wilson Ave., Chicago, Ill.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, W. J. Husing, 729 McMakin Ave., Cincinnati, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. M. E. Zadowski, 6517 Bridge Ave.

HARTFORD-CONN. VALLEY

Meets in Springfield on alternate months. The Hartford meetings are held at the Hartford Engineers' Club, 12 Haynes St., and the Springfield meetings are held at the Springfield Chamber of Commerce, Broadway and Worthington St., Springfield. Tennant Elwin, Secretary, 117 Hobart St., Meriden, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Albert Bates, Box 34, Vandalia, Ohio.

DETROIT

Meets the first and third Friday of each month at the Detroit Testing Laboratory, 554 Bagley Ave., Detroit. Secretary, Geo. Kutxen, 1087 W. State Fair Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Wednesday of each month at the Vocational High School, 129 Bostwick Ave., N. E. Secretary, John Raven, 1139 Emerald Ave., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

MILWAUKEE

Meets second and fourth Thursdays of each month at Lipps Hall, 321 3d St. J. N. Hock, 310 Galena St., Milwaukee, Wis.

MONTREAL

Meets last Friday of month at Office of Secretary, John H. Feelay, 411 Aylmer St., Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Hotel St. Francis, 22-24 E. Park St., Newark, N. J., at 8 p. m. Secretary-Treasurer, Royal F. Clark, 55 Seymour Ave., Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary, J. E. Sterling, 2595 45th St., Astoria, L. I.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Saturday of each month at 8 p. m., at United States Bureau of Mines Bldg., Forbes St. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 184 Washington St., Room 308, Providence, R. I. Secretary, J. H. Andrew, 19 Rosedale St., Providence, R. I.

ROCHESTER

Meets every second and fourth Saturday of each month at the Powers Hotel. C. A. Reama, Secretary, 512 Lyell Ave., Rochester, N. Y.

ST. LOUIS

Meets first Tuesday of each month at Barr Branch Library, corner Jefferson and Lafayette Sts. Secretary, F. P. Menniges, 4019 Molozan Ave.

TOLEDO

Meets first Thursday of each month at Toledo University Science Building, Electro-Platers' Room, corner Cherry and Page Sts. Secretary, W. W. Weiker, 411 3d St., Toledo, Ohio.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. J. C. Cairns, 10 Wilshire Ave., Toronto, Ontario, Canada.

WATERBURY

Meets every second and fourth Friday of each month. Secretary, Wm. F. Guilfoile, 14 Oakland Ave., Waterbury, Conn.